

PHIALICORONA PLEOMORPHA GEN. ET SP. NOV. AND ITS SYNANAMORPHS

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ABSTRACT - An interesting dematiaceous phialidic polymorphic hyphomycete collected on *Canarium littorale* Blume (Burseraceae) from Singapore is described. The characteristic apical crown of phialides, the slimy one-celled conidia and the robust mostly unbranched phialophores ■■ distinctive. In addition, the association of three synanamorphs, assigned here to *Sporidesmiella*, *Selenosporella* and *Heteroconium*, is unique. The taxonomy of the fungus is discussed. It is accommodated in a new genus, *Phialicorona*, ■ a new species, *P. pleomorpha*.

RÉSUMÉ - Description d'un hyphomycète dématié phialidique (pléomorphe) récolté sur *Canarium littorale* Blume (Burseraceae) à Singapour. La couronne apicale de phialides, des conidies unicellulaires muqueuses et les phialophores robustes, généralement non ramifiés sont caractéristiques. L'association de trois synanamorphes rapportées aux genres *Sporidesmiella*, *Selenosporella* et *Heteroconium* est unique. Un genre nouveau: *Phialicorona* et une espèce nouvelle, *Ph. pleomorpha* sont proposés.

As part of the programme of work on microfungi of the tropics, the author is currently engaged in a study of his collections from Singapore made during his stay at the National University of Singapore in 1986-87. An interesting fungus was collected on bark of *Canarium littorale* Blume (Burseraceae). The fungus is described and its taxonomy is discussed in this paper.

DESCRIPTION OF THE FUNGUS

The fungus forms brown to brackish velvety colonies on the substratum. The mycelium is superficial, composed of thin-walled, hyaline to subhyaline to straw-coloured, septate, branched hyphae 2-4 μm wide, becoming thick-walled and brown to dark brown later. The conidiophores arise from the hyphae and are of three kinds representing three morphs: a phialidic morph for which a name has to be found, a gangliar morph which appears to be ■ *Sporidesmiella*, a third which is a *Selenosporella*; yet another synanamorph, tentatively assigned to *Heteroconium*, may also be present.

THE PHIALIDIC MORPH

The phialophores arise from cells of vegetative hyphae, often along with *Sporidesmiella* conidiophores from the same hypha or from the same cell (Fig. 1, 2)



Figs. 1-8. *Phialicorona pleomorpha* and its synanamorphs. Figs. 1-3, phialophores showing connection with *Sporidesmiella* (Fig. 1, 3) and *Heteroconium* (Fig. 1) synanamorphs, the longer conidiophore in fig. 3 ■ a *Sporidesmiella* conidiophore in which a phialide cluster has developed from the conidiogenous and conidial cells. Figs. 4-7, phialide clusters, conical (Fig. 4, 6), subglobose (Figs. 5, 7). Note slender filiform phialoconidia attached to phialides in Figs. 5-7. Fig. 8, ■ *Sporidesmiella* conidiophore with *Selenospora* conidiogenous cells developing on the conidium. Figs. 2, 4-6 ex S 32, the rest ex TYPE (No S 33). Bar connotes 10 μ m.

quite often close to each other. The basal cell of the phialophore is often swollen and large, 10-12 μm tall, 10-11 μm wide. A number of simple rhizoid-like hyphae may arise from the basal cell (Fig. 9) though often creeping or trailing on the surface of the substratum. Such rhizoidal hyphae may not always be present (Fig. 2). The phialophores are macronematous, mononematous, stout, erect, straight or bent, simple, up to 7-septate, 50-100 μm long, 4.5-9.0 μm wide, 4.5-6.0 μm wide at the tip, brown to dark brown, thick-walled, cylindrical to subcylindrical, bearing a complex and compact apical cluster of phialides directly on the phialophore (Fig. 4) or on the stipe and its penicillus of branches, branches and phialides usually arising from immediately below a septum (Fig. 14). The entire apical phialidic cluster simulates a cone in shape (Fig. 4-6) or may be globose or subglobose (Fig. 1, 7), 13-40 μm tall, 13-40 μm wide, mostly the height exceeding the width. The phialides (Fig. 14) vary in shape but typically they are lageniform or have a globose body and short narrow pointed neck, hyaline to subhyaline, thin-walled, smooth, 5.0-7.5 μm long, and 3-4 μm wide. The phialoconidia (Fig. 5-7, 20) are solitary, hyaline, small, bacillar, one-celled, thin-walled, smooth, solitary, slimy, 4-5 μm long and 1.5 μm wide. The development of phialides and phialide clusters is shown in Figs. 17-19.

It has not been easy to find a suitable generic name for this phialidic fungus. On the basis of its key features, viz., the simple phialophores crowned by a complex and closely packed cluster of phialides and the solitary, slimy, one-celled phialoconidia, it invites comparison with the following genera: *Goidanichiella* Arnaud ex Barron, *Gloiosphaera* v. Hoehnel and *Phialocephala* Kendrick. In *Goidanichiella* (type species *G. scopula* (Goidanich) Barron: Barron, 1968; Arnaud, 1953), the phialides arise from a terminal globose swelling on the phialophore. The phialophore in the present fungus lacks an apical swelling and so cannot be placed in *Goidanichiella*. For this reason, it is also quite distinct from *Stachybotrys* Corda, *Gliocephalis* Matruchot and the recently described *Knoxdaviesia* Wingfield, van Wyk & Marasas (1988). In *Gloiosphaera* (type species: *G. globulifera* v. Hoehnel = *G. clerciana* (Bondier) v. Hoehnel: Wang, 1971; Pollack & McNight, 1972) the phialophore is hyaline, becoming pale yellow with age, simple and septate; the distal and apical cells are fertile. Metulae arise from below septa, several per cell from each of these cells and each metula in turn bears a cluster of phialides. The phialides are subulate to filiform. The conidia are solitary, slimy, oval, hyaline and one-celled. In the present fungus, the phialophores are distinctly dematiaceous and the phialides arise directly on the phialophore at its tip and from below septa, several per cell (Fig. 14); the apical cell and a few subterminal cells on the stipe are phialidiferous. Frequently, short branches may arise from below septa from a few distal cells immediately below the apical cell and these branches bear clusters of phialides at their apices and laterally below septa when the branches are septate. The branches form a penicillus at the apex of the phialophore (Fig. 13, 14). These features distinguish the present fungus from *Gloiosphaera* and other genera. In *Phialocephala* (type species, *P. dimorphospora* Kendrick) (Kendrick, 1961), the phialophore is simple and bears apically a penicillus or system of primary and succession of superimposed branches and the ultimate bran-

Figs. 1-8. *Phialicorona pleomorpha* et ses synanamorphes. Figs. 1-3, phialophores montrant la relation avec les synanamorphes de *Sporidesmiella* (Fig. 1, 3) et *Heteroconium* (Fig. 1). Le long conidiophore (Fig. 3) est un *Sporidesmiella* où un bouquet de phialides s'est développé sur des cellules conidiogènes et conidiennes. Figs 4-7, bouquets de phialides coniques (Figs. 4, 6) et subglobuleuses (Figs. 5-7). Fig. 8, conidiophore de *Sporidesmiella* avec des cellules conidiogènes de *Selenospora* se développant sur la conidie. Figs. 2, 4-6 ex S 32, les autres ex Type (N° S 33). Echelle = 10 μm .

ches bear finger-like phialides each with a prominent cup-like collarette from within which endogenously cleaved out and differentiated conidia are produced: the conidia are 1-celled, subglobose, and slimy. The present fungus is clearly not congeneric with *P. dimorphospora*.

Conidiogenesis in *P. dimorphospora* is also quite different (see Carroll & Carroll, 1974; Subramanian, 1983, p. 70; Wingfield, van Wyk & Wingfield, 1978).

There are several genera of dematiaceous phialidic hyphomycetes in which the phialophores are setiform, e.g. *Kionochaeta* Kirk & Sutton and *Zanclospora* Hughes & Kendrick (Kirk & Sutton, 1985). The present fungus stands apart from all of them in that the phialophore is not setiform and bears a complex apical cluster of phialides.

So far as the author is aware, there is no hyphomycete genus known in which this phialidic anamorph can be appropriately placed. Accordingly, it is accommodated in a new genus, *Phialicorona* as a new species, *P. pleomorpha*.

PHIALICORONA Subramanian anamorph. gen. nov.

(Etym. from Latin, *Phialid* = vessel, cup; *corona* = crown, apical cluster).

Dematiaceous hyphomycete producing phialoconidia. Mycelium composed of branched, septate, subhyaline to brown hyphae. Phialophores macronematous, mononematous, simple, erect, brown, septate, terminating in a compact cluster of phialides. Basal cell of phialophore often subtended by simple, rhizoid-like radiating hyphae. Phialides arising at the tip of the apical cell and from below septa on a few subterminal cells, also from cells of penicillate, septate, short branches arising from below septa on cells subterminal to the apical cell of the phialophore, lageniform, hyaline to subhyaline. Conidia solitary, hyaline, one-celled, slimy.

PHIALICORONA Subramanian anamorph gen. nov.

Hyphomycete dematiacea phialoconidia producente. Mycelium ex hyphis ramosis, septatis, subhyalinis vel brunneis compositum. Phialophora macronematosa, mononematosa, simplicia, erecta, brunnea, septata, une racemi compacti phialides terminata. Cellula basalis saepe e hyphis simplicis rhizoideis vel radiatis oriunda. Phialides in apicibus phialophorum vel in cellulibus subterminalibus phialophorum vel ramorum infra septa in verticillio evolutae, hyalinae vel subhyalinae, lageniformes. Conidia solitaria, hyalina, continua, mucosa.

Synanamorphoses: *Sporidesmiella*, *Selenosporella*, *Heteroconium*.

Type species: *Phialicorona pleomorpha* Subramanian anamorph sp. nov.

Colonies velvety, brownish to blackish. Mycelium superficial, composed of thin-walled, smooth, hyaline to subhyaline, septate, reticulately branched hyphae 2-4 μm wide, becoming thick-walled, brown to dark brown later. Phialophores arising from vegetative hyphae, often along with *Sporidesmiella* and/or *Selenosporella* conidiophores. Basal cell swollen, large, often with simple, rhizoid-like, radiating hyphae, 10-12 μm tall, 9-11 μm wide. Phialophores macronematous, mononematous, stout, erect, straight or bent, simple, up to 7-septate, 50-100 μm long, 4.5-9.0 μm wide, 4.5-6.0 μm at the tip, brown to dark brown, thick-walled, cylindrical to subcylindrical, bearing a complex and compact apical cluster of phialides directly on the phialophore or on the stipe and its penicillus and branches; branches and phialides usually arising from immediately below septa. Phialide cluster cone-like or globose to subglobose, 13-40 μm tall, 13-40 μm wide, the height usually exceeding the width. Phialides lageniform or globose with short narrow neck, hyaline to subhyaline, thin-

walled, smooth, 5.0-7.5 μm long, 3-4 μm wide. Conidia solitary, small, hyaline, bacillar, one-celled, thin-walled, smooth, slimy, 4-5 μm , 1.5 μm wide.

Synanamorphs present: *Sporidesmiella*, *Selenosporella*, *Heteroconium*.

Type: on bark of *Canarium littorale* Blume (Burseraceae), Botanical Garden, Singapore, 12.ii.1987. Coll. C.V. Subramanian, Subnumero S 33.

Other Collection: on bark of *Canarium littorale*, Botanical Garden, Singapore, 12.ii.1987, Coll. C.V. Subramanian, Sub numero S 32.

Descriptions of synanamorphs follow:

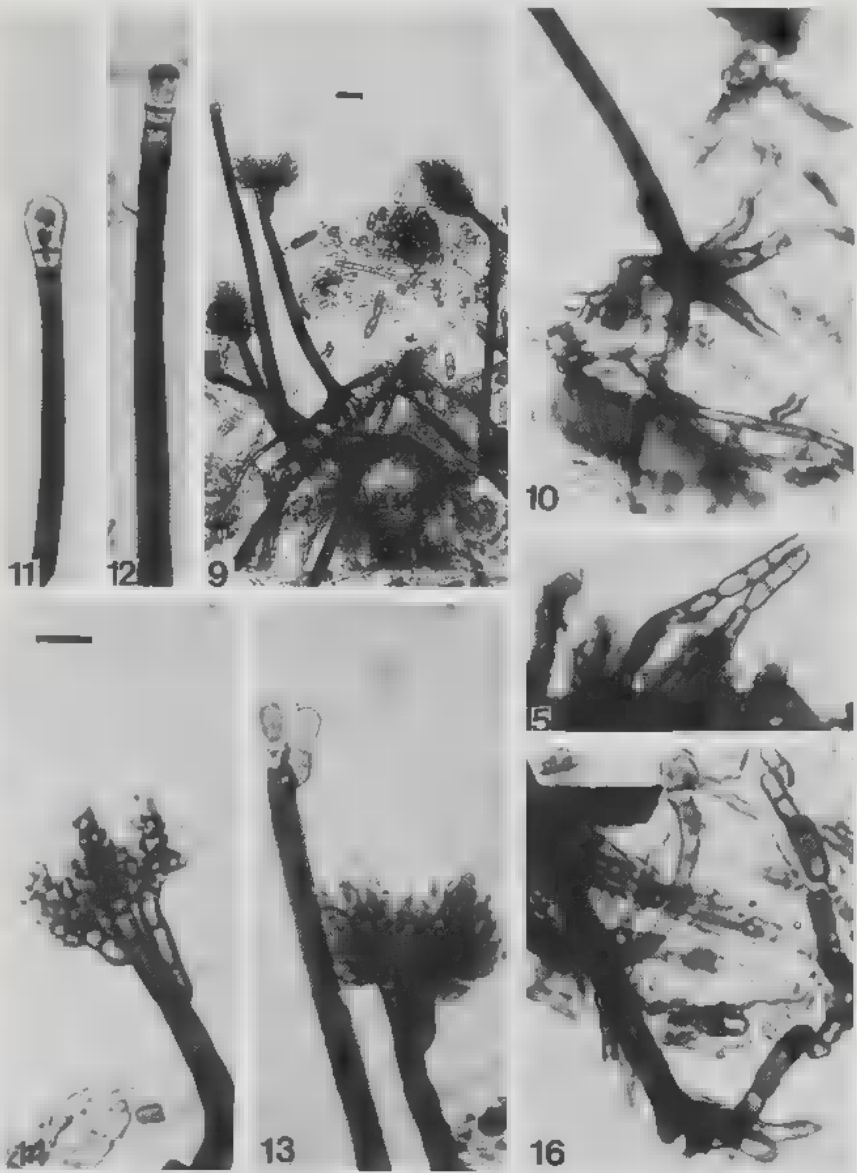
The *Sporidesmiella* synanamorph

The *Sporidesmiella* synanamorph is common and attracts immediate attention not only by its conspicuousness but also its occurrence and origin from the same hyphae from which the phialophores (of the *Phialicorona* state) or the *Selenosporella* conidiophores arise (Fig. 1, 2, 9). The conidiophores are generally longer than the phialophores (Fig. 1, 2, 9), 135-280 μm long, 4.5-6.0 μm wide, 3.7-4.5 μm at the apex, simple, macronematous, mononematous, erect, straight or bent, dark brown, cylindrical, thick-walled, 6-11-septate, arising laterally from repent hyphae. The basal cell is large, swollen, brown, thick-walled, 10-12 μm tall and 9-11 μm wide and may be subtended by simple, radiating rhizoid-like hyphae (Fig. 10). The conidiogenous cell is integrated, apical and percurrent (Fig. 11, 12, 22). The conidia are hyaline to subhyaline, short-clavate, smoothly rounded at the apex, unequally 1-septate, sometimes 2-3 septate, gangliar, solitary, acrogenous on the conidiogenous cell and its percurrent proliferations (Fig. 11, 12). The one-septate conidia are 9-17 μm long and 5-7 μm wide and the 3-septate ones 30-35 μm long, 8-10 μm wide. Some conidia suggest an endogenous origin (Fig. 21) from the conidiogenous cell whose wall is split to expose the developing conidium and the conidiferous part of the conidiogenous cell then presents a cupular aspect (Fig. 11, 12, 22). Surprisingly, no detached or free conidia have been seen and it looks as if they are not easily shed. And yet, the occurrence of one or two closely spaced annellations on the conidiogenous cell (Fig. 12) suggests percurrent proliferation followed by conidiogenesis. A conidium may sometimes be produced subterminally and laterally (Fig. 13, 23) from below the septum cutting off the apical conidium. These conidia are also gangliar. Occasionally, a few phialides or even clusters of phialides may be produced from the conidiogenous cell, subterminal to the apical conidium (Fig. 24-26). A conidium may also produce *in situ* *Selenosporella* (Fig. 28, 29) or *Phialicorona* conidiogenous cells (Fig. 24-26).

The taxonomic disposition of this synanamorph is not easy. Neither *Endophragmia* Duvernoy & Maire (see Hughes, 1979) nor "*Endophragmia* auct" as treated by Ellis (1971, 1976) is suitable. The closely annellated, integrated, apical conidiogenous cell, the genesis of the conidia and their general morphology and distoseptation suggest that the nearest, though not the best, disposition could be in *Sporidesmiella* P.M. Kirk (1982). In the type species of this genus, *S. claviformis* P.M. Kirk, the conidia are clavate and (2-)distoseptate as in the present fungus. Accordingly, this synanamorph is assigned to *Sporidesmiella*, but tentatively, as detached conidia have not been observed despite the abundance of conidiophores bearing conidia.

The *Selenosporella* synanamorph

The *Selenosporella* synanamorph is observed frequently, though it is not as conspicuous as the *Sporidesmiella* synanamorph. The conidiophores are very much like



Figs. 9-16. *Phialicorona pleomorpha* and its synanamorphs. Fig. 9, association of phialophores with *Sporidesmiella* and *Heteroconium* morphs. Note rhizoidal hyphae radiating from basal cell of phialophores and the *Sporidesmiella* conidiophore. Fig. 10, basal part of *Sporidesmiella* conidiophore showing swollen basal cell and radiating, creeping rhizoid-like hyphae. Fig. 11, 12, *Sporidesmiella* conidiophores with attached conidia. Fig. 13, phialide cluster showing disposition of phialides on main stipe and on the penicillus of septate branches. Fig. 14, another phialide cluster (note conidium attached to a phialide) and a *Sporidesmiella* conidiophore with a terminal conidium and a subterminal lateral one. Fig. 15, 16, conidiophore and conidia of the *Heteroconium* synanamorph. Note in Fig. 16 origin of the *Heteroconium* conidiophore from the hypha that gives rise to a *Phialicorona* phialophore. Note also chain of *Heteroconium* conidia. Figs. 9-10, 12-16 ex Type (S 33), the rest ex N° 32. Bar connotes 10 μ m.

those of the phialidic and the *Sporidesmiella* morphs: the basal cell is conspicuous, up to 10-12 μm wide and 9-11 μm tall, and may be subtended by simple, rhizoid-like hyphae. The conidiophores are generally longer than the *Phialicorona* phialophores, but slightly shorter than conidiophores of the *Sporidesmiella* morph, up to 6-septate, 110-160 μm long, 6.0-7.0 μm wide, 3.7-4.5 μm wide at the apex; they are macronematous, mononematous, simple, erect, straight or bent, brown, cylindrical to subcylindrical, thick-walled and septate. The conidiogenous cells (Fig. 27) are discrete and form a terminal diverging cluster on the conidiophore: terminal on the apical cell, and lateral and subseptal on a few subapical cells. They are polyblastic, somewhat paler than the rest of the conidiophore, 10-18 μm long, 3.0-5.2 μm wide, each with up to a dozen scars. The conidia are solitary, hyaline to subhyaline, obovate, thin-walled, smooth, dry, 6.0-7.5 μm long and 2-3 μm wide.

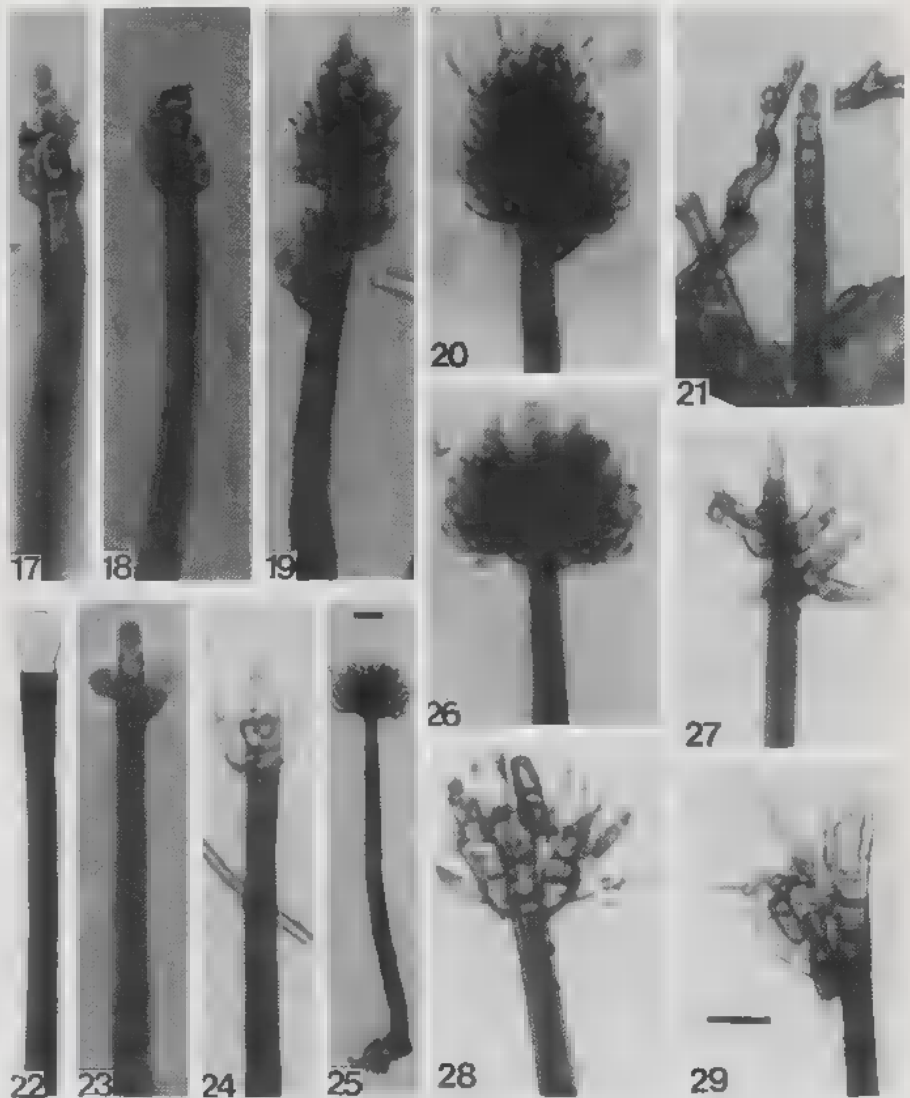
The simple, brown, mononematous, septate conidiophores, the apical cluster of characteristic polyblastic conidiogenous cells and the solitary, one-celled, dry conidia suggest that *Selenosporella* could be a suitable genus to which this synanamorph can be assigned. *Selenosporella* conidiogenous cells can arise sometimes from cells of conidia of the *Sporidesmiella* morph (Fig. 28, 29), though this is rare.

The *Heteroconium* synanamorph

What has been tentatively identified as ■ *Heteroconium* state is always present - physically linked to hyphae from which conidiophores of the *Phialicorona* and the *Sporidesmiella* states arise (Fig. 1, 9, 15, 16). The vegetative hyphae are pale to straw-coloured, turning brown, branched, thin-walled, smooth, septate, connected directly to rhizoid-like hyphae or to vegetative hyphae of the *Phialicorona* or other state (Fig. 1, 16). The conidiophores are mononematous, short, mostly terminal on hyphae, up to 20 μm long, 3-5 μm wide, septate, subhyaline to brownish. The conidiogenous cell is integrated, apical and monoblastic. The conidia are formed in simple acropetal chains, separating easily, cylindrical, flattened or smoothly rounded at both ends, subhyaline to brown, mostly 1-3-septate, sometimes up to 5-septate, smooth, dry, 10-20 μm long and 3-4 μm wide (Fig. 15).

From mere observation of detached conidia one may be tempted to consider this a *Bahusakala* or a *Septonema*. The relatively short and simple conidiophores and the simple acropetal chains of blastic phragmoconidia suggest ■ *Heteroconium* rather than a *Septonema*. The type species of *Heteroconium* Petrak, *H. citharexyli* Petrak (see Ellis, 1971, 1976) is ■ foliicolous fungus; other species in this genus, viz. *H. chaetospora* (Grove) M.B. Ellis, *H. solaninum* (Sacc. & Syd.) M.B. Ellis, and *H. tetracoilum* (Corda) M.B. Ellis are quite distinct from *Septonema* and perhaps also

Figs. 9-16. *Phialicorona pleomorpha* et ses synanamorphes. Fig. 9, association de phialophores avec les formes *Sporidesmiella* et *Heteroconium*. On note les hyphes rhizoïdiennes rayonnantes à partir de la base des phialophores et des conidiophores de *Sporidesmiella*. Fig. 10, partie basale d'un conidiophore de *Sporidesmiella* montrant une cellule basale élargie et des hyphes rhizoïdiennes rayonnantes. Fig. 11, 12, conidiophores de *Sporidesmiella* avec une conidie attachée. Fig. 14, bouquet de phialides montrant la position des phialides sur le stipe principal et sur les branches cloisonnées. Fig. 13, autre bouquet de phialides (noter la conidie attachée à la phialide) et conidiophore de *Sporidesmiella* avec une conidie terminale et une latérale subterminale. Fig. 15, 16, conidiophore et conidie de la synanamorphe *Heteroconium*. Figs. 9-10, 12-16 ex Type (S 33), les autres ex N° S 32. Echelle = 10 μm .



Figs. 17-29. *Phialicorona pleomorpha* and its synanamorphs. Figs. 17-19, development of phialides and phialide cluster. Fig. 20, a phialide cluster with several conidia still attached to the phialides. Figs. 21-22, development of *Sporidesmiella* conidia: note endogenous development in Fig. 21. Fig. 23, a *Sporidesmiella* conidiophore with conidia developing terminally and subterminally. Figs. 24-26, a *Sporidesmiella* conidiophore showing the development of phialides thereon. Fig. 27, distal part of *Selenospora* conidiophore and the characteristic conidiogenous cells. Fig. 28, 29, *Sporidesmiella* conidiophore showing development of *Selenospora* conidiogenous cells from the conidia and conidiogenous cell. Note conidium attached to conidiogenous cell in Fig. 28. Figs. 20-23 ex N° S 32, the rest ex Type N° S 33. Bar connotes 10 μ m.

from *Heteroconium*. The present fungus has also some features of *Xylohypha* (Fries) Mason, especially the easy secession of the conidia, but *Xylohypha* by description has typically 1-celled (rarely 2-celled) conidia and the conidial chains may be branched occasionally. Tentatively, this synamorph is assigned to *Heteroconium*.

***Phialicorona pleomorpha* Subramanian anamorph sp. nov.**

Coloniae velutinae, brunneolae vel atrae. Mycelium superficiale, ex hyphis tenuitunicatis, laevis, hyalinis vel subhyalinis, septatis, reticulatim ramosis, 2-4 μm latis, posterius crassitunicatis vel brunneis vel atrobrunneis compositum. Phialophora ex cellulis hypharum mycelialium inflatis (circa 10-12 μm altes, 9-11 μm latis) lateraliter oriunda, macronematosa, mononematosa, robusta, erecta, recta vel flexa, simplicia, usque ad 7 septata, 50-100 μm longa, 4.5-9.0 μm lata, 4.5-6.0 μm lata ad apicem, brunnea vel atrobrunnea, crassitunicata, cylindrica vel subcylindrica, une racemi compacti phialides terminata; cellula basalis saepe e hyphis simplicis, rhizoideis vel radiatis, 10-12 μm latis, oriunda. Phialides in apicibus phialophorum vel in cellulis subterminalibus phialophorum vel ramorum infra septa in verticillis evolutae, hyalinae vel subhyalinae, lageniformes, laeviae, 5.0-7.5 x 3-4 μm . Conidia solitaria, hyalina, bacillaria, continua, tenuitunicata, laevia, mucosa, 4.5 x 1.5 μm .

Synanamorphosae: *Sporidesmiella*, *Selenosporella*, *Heteroconium*.

Typus: in cortice Canarii littorali Blume, (Burseraceae), horto botanico, Singapore, leg. C.V. Subramanian, 12.2.1987 Subnumero S 33.

Alliae collectione: in cortice Canarii littorali Blume, horto Botanico, Singapore, leg. C.V. Subramanian, 12.2.87 Subnumero S 32.

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Figs. 17-29. *Phialicorona pleomorpha* et ses synanamorphes. Figs. 17-19, développement des phialides en bouquet. Fig. 20, bouquet de phialides avec conidies encore attachées aux phialides. Figs. 21-22, développement des conidies de *Sporidesmiella*. On note le développement endogène de la conidie figure 21. Fig. 23, conidiophore de *Sporidesmiella* avec conidies terminale et subterminale. Figs. 24-26, phialides se développant sur un conidiophore de *Sporidesmiella*. Fig. 27, partie distale d'un conidiophore de *Selenosporella* avec cellules conidiogènes caractéristiques. Fig. 28, 29, conidiophore de *Sporidesmiella* avec développement de cellules conidiogènes de *Selenosporella* à partir de conidies et de cellules conidiogènes. Fig. 28, ■ note la conidie encore attachée à la cellule conidiogène. Fig. 20-23 ex N° S 32, le reste ex Type N° S 33. Echelle = 10 μm .

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